

## Innovative education practice of biochemistry teaching in agricultural university

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**Abstract:** It is elaborated how to cultivate innovative talents through biochemistry teaching in Agricultural University In the following ways. (1) Teacher should innovate existing education ideas and set up the correct education ideas. (2) Cultivating students' innovation consciousness. (3) Deepening teaching reform for students having reasonable knowledge structure. (4) Paying attention to experiment teaching and improving the students' practical skills. (5) Cultivating the students' innovative thinking ability in the process of biochemical teaching innovation.

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### 1. Introduction

Jiang Zemin pointed out: "Innovation is the soul of a nation and an inexhaustible power for the development of country. A country, without it, is difficult to strive in the world" at the national science and technology conference. In recent years, innovative educational reform has been recognized as the key to the reform of education system in our country. The university is the place where cultivates higher level talent, and the talents is the hope of a country, so the main task of the university is the cultivation of the innovative talents.

Biochemistry, as the foundation of modern molecular biology and the basic language to describe the life science, can reveal the nature of the life phenomenon. Along with the coming of biology century and the implementation of human genome project, the agriculture develops toward high and new technological innovation, and biochemistry course has irreplaceable role in the development of agricultural colleges. As a student in biology science field, who whether can grasp the solid basic skills and innovate in life science field or not, depends on training the ability of students' thinking, practice and innovation in the biochemistry teaching process.

### 2. Teacher should innovate existing education ideas and set up the correct education ideas

The key of comprehensive promotion of quality education is the headmaster and teacher. To cultivate the talent with innovative spirit and ability, education itself need innovation, and teachers need more innovative consciousness, spirit and ability (Huang, 2000). Therefore, to innovate biochemical education, teachers must innovate the existing education concept, and clearly recognized what the innovative talent is.

The innovative talents must have the innovative ability and innovative consciousness, so the

innovation process reflects a comprehensive quality a person. Innovative ability of the person can be reflected in the creative process, and it includes not only creative thinking ability but also the reasonable structure of knowledge and practical ability. The three abilities are collaborative during the process of innovation, and creative thinking ability is the most important ability. Since the innovation ability only emerges in the process of innovation, why don't we cultivate the students' innovation ability and innovation consciousness in the biochemical teaching innovation process? For example, on teaching some chapters (vitamin and coenzyme, etc), firstly, we can give students some questions about teaching contents (such as relationship of vitamins and coenzyme). And then the students study the knowledge by themselves. At last, after the questions are sufficiently discussed by students, the teacher can explain in detail and summarized according to the students' understanding of the knowledge. In the solving problem process, innovation ability and innovation consciousness of the students have been trained and exercised.

It has been proved that wide knowledge and expert skills can expand thoughts, deeply analyze, and solve problem with different methods during innovation process. At the same time, wide knowledge and expert skills can help a person present and achieve novel and unique hypothesis. Otherwise, the innovation education will be no sense. Therefore, students' basic knowledge accumulation and the training of basic skills about biochemistry should be paid attention in innovation education.

### 3. Cultivating students' innovation consciousness

Students not only master the biochemical theory and skills, but also wide knowledge and view. In the teaching some key knowledge, such as glycolysis, teachers not only elaborate glycolic reaction process, but also narrate the discovery history of glycolysis.

Buchner brother discovered glycolysis accidentally, and then scientists further research it. Until 30 years later, glycolytic pathway was completely clarified. It not only increases the students' interest of study, but also make the students know how the scientists discover, think and research question, making a creative conclusion. In addition, some unresolved problems is put out in the main chapter, which let students understand there are still many problems waiting for them to solve, increasing the students' interest of study and cultivating the students' independent thinking ability and innovation consciousness.

#### **4. Deepening teaching reform for students having reasonable knowledge structure**

The work of most students in agricultural colleges is to guide all kinds of crops production, therefore, biochemical teaching content should be chose according to the following principles. Firstly, it should be the most useful content for student's lifelong development and guiding agriculture after graduated. Secondly, it can be grasped by the students through efforts. Thirdly, it should be helpful to students' quality and ability improvement. Fourthly, it should be close to students' major.

We reform our textbooks on the basis of the above principles. ① 《 Basic biochemistry 》 for undergraduate students was published. In the process of writing the textbook, to let the students master the basic knowledge of biochemistry as much as possible in the limited time and study the latest biochemical discipline, technology and frontier dynamic knowledge, each chapter was divided into three parts. The first part is teaching content studied in the lesson. The second part is new content for further reading, introducing some of the latest knowledge, technology and frontier dynamic knowledge. The third part is exercises, which include what will be learned in this chapter (Liu and Chen, 2001; Liu, 2009) . ② 《guide on learning biochemistry》 was published, which is helpful for students to study by themselves. ③ 《 Biochemical experiment and technology 》 was published by science press. The book is different from the old traditional writing mode of biochemistry experiment instruction. The contents in the book are divided into three parts. The first part is the principle of experiment method and technology in biochemistry, introducing modern biochemical technology systematically and briefly. The second part is biochemical experiment, containing five units (basic training, basic experiment, key experiment, synthetic experiment, selective experiment). These experiment contents are focused on training student's ability and quality. The last part includes some appendixes, which is frequently used in biochemistry (Chen, 2002). ④The

multimedia courseware was made, including rich content and vivid cartoon, which can intuitively show the fine structure of biological macromolecule and complex biochemical process. The multimedia courseware makes the students get a lot of knowledge and information in limited time and improves the teaching efficiency.

#### **5. Paying attention to experiment teaching and improving the students' practical skills**

##### **(1) Constructing "two series, multi-level" system of experiment course**

Two series of experimental teaching are carried out in our university. Namely, the experiment course and theory course are examined separately. This teaching model is helpful for the students paying more attention to experiment course. In addition, according to the requirements of various educational levels and majors, we establish a multiple levels of teaching program.

##### **(2) Reform and innovation of the experiment teaching contents**

In order to ensure experiment course including scientific and practical experiment, we arrange the experiment contents according to the following principles. Firstly, centering on centrifuge, chromatography and electrophoresis experiment technology, we arrange quantitative experiments and basic skill training experiments as much as possible (such as determination of protein contents, the assay of enzyme activity, determination of proteins isoelectric point, etc.). Secondly, more new methods and technology should be learned, and more new instruments should be used by students, focusing on the training of the students' basic skills. If some new technologies are not carried out, students may learn them through multimedia.

##### **(3) Combining teaching with scientific research**

It has been proved by the world higher education history and the experience of the reform and opening in China that the science research has a close relation to teaching. To accomplish the teaching well, teachers must master their own professional knowledge and have high level of scholarship. In the experiment teaching, teachers instruct biochemical technology and principle with combination of scientific research experience. It can not only make the students master the biochemical technology, but also improve theirs experiment ability of the science research. In addition, the teachers encourage students participate in the teachers' research, which make their knowledge learned in class to be applied and proved in practice. Consequently, the students' learning enthusiasm can be further aroused, and students' thinking and innovation ability in the science research can also be developed.

## 6. Cultivating the students' innovative thinking ability in the process of biochemical teaching innovation.

In recent years, we excavated deeply the innovation process of biochemical teaching seriously, and cultivate students' innovative thinking ability through looking for the innovation thinking in innovation process.

### (1) Establishing innovative thinking model diagram to cultivate students' innovative thinking ability.

In the teaching process, teachers should establish the innovative thinking model diagram in some sections, such as proteins and nucleic acid. The learned knowledge can be integrated with biochemistry knowledge in this innovative thinking model diagram. To train students' weak ability of divergent thinking, teachers should guide the student to learn how to build creative thinking diagram, and how to study creatively with divergent thinking and oriented thinking. For example, when the relation of diverse metabolisms is taught, the model map can be made including the knowledge of sugar, lipid, protein and nucleic acid metabolism, and their relationship can be found out in reading the map.

### (2) Using the heuristic teaching method to train students' creative thinking ability.

General teaching method is to explain textbook knowledge systematically according to the teaching program. Different from general teaching method, students are required to participate initiatively and actively into teaching in heuristic teaching method, consequently teaching and study can be mutually promoted. Bruner, an American psychologist, said "The discovery not limited to understand unknown things, and it also includes getting knowledge using yourself brains". Therefore, learning new knowledge under enlightenment is an innovative process that students reorganize and retrofit evidence to discovery knowledge. This innovative process can train students' keen insight and innovative thinking ability (Feng, 1985). In the teaching process, we should especially pay attention to the following two aspects. Firstly, providing suitable situations for founding the questions is the key to success or failure in heuristic teaching, and training students' ability to solve problems is the important part of heuristic teaching process. In the teaching, teachers should purposefully question and ask students, and let the students find out problems by themselves, improving the students' interest in study. For example, on explaining energy calculation method of a molecular palmitic acid after thoroughly oxidative decomposition in lipid metabolism, teachers can let students tried to calculate the energy release of a fatty acid including 22 carbon atoms. Secondly, class discussion and summary should be carried out. Students can learn and enlighten each other in the

discussion, finding the right regularity knowledge. Discussion can make problems into the open and clear, arousing the student s' enthusiasm for studying. Discussion can also make the students grasp knowledge more profoundly and find new problems gradually.

### (3) The important thing to improve students' innovative thinking ability is to update experiment teaching idea.

Experiment teaching content is divided into basic experiments and comprehensive experiments. Basic experiments mean the basic biochemical experiments that students should do in this semester. Comprehensive experiments are the reasonable combination of basic experiments. This experiment arrangement will help students to training their innovative thinking and the ability of using knowledge. Some comprehensive experiments were carried out according the experimental conditions in our university, such as seed protein system analysis, PAL purification and activity determination, bromelain dynamic measurement, and so on. In addition, some small exploratory and design experiments are carried out. We encourage students establish science research groups and design experiment plan under the teachers' guidance. For example, students in agriculture major can design the experiment that how to use biochemical technology to test corn seeds. The exploratory and design experiments can not only improve students' innovation thought and experiment skills, but also make them realize the importance of team spirit.

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